

SCIENCE SAFETY MANUAL FOR SCHOOLS

Red Clay Consolidated School District

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FOREWORD

The purpose of this document is to provide a framework for science teachers in the Red Clay Consolidated School District to conduct instruction in a safe and responsible manner. Safety is everybody's responsibility. Safety procedures, like curriculum and classroom management, must be planned and implemented consistently to become effective. This document will provide the following for the science classroom instructor or administrator:

1. An outline of safe practices for a variety of classroom situations. Included are policies that promote safety and specific cautions against practices that are considered unsafe for schools.
2. A list of procedures and persons responsible for accountability of safe practices as well as information about whom to contact in case of problems.

SAFETY PHILOSOPHY OF THE RED CLAY CONSOLIDATED SCHOOL DISTRICT

Laboratory inquiry and investigation are the hallmarks of effective science instruction at all levels and all grades. All laboratory work, whether it occurs with chemicals, with electricity, with living organisms, or in a natural outdoor environment, poses some degree of risk.

The goal of the Red Clay Consolidated School District is to provide an effective and consistent safety plan that follows the following format:

1. Ongoing safety training of students and staff throughout the school year
2. Annual documented training of science students and science instructors **before** any laboratory instruction begins.
3. Modeling of safe procedures by all Red Clay staff.
4. Accountability of hazardous materials used in schools, including communication of hazardous information at the school level and at the district level.
5. Designation of a science safety officer at each high school.

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SAFETY RESPONSIBILITIES OF THE CLASSROOM TEACHER

Classroom teachers are expected to provide a standard of safety in their teaching environments. The Council of State Science Supervisors (CSSS) identifies three basic duties of the science teacher that relate to **laboratory safety**.

- 1) Duty of Instruction: adequate instruction before a laboratory activity.
- 2) Duty of supervision: adequate supervision of students that they behave properly to avoid foreseeable dangers.
- 3) Duty of maintenance: assurance that the teacher maintains a safe environment and properly functioning equipment for instruction.

Guidelines for Duty of Instruction:

- 1) Safety rules should be posted in the classroom in a prominent place.
- 2) Students must be thoroughly instructed in those safety considerations and procedures relevant to the class before any potentially hazardous work begins. This instruction must be:
 - Accurate
 - appropriate to setting
 - appropriate for the maturity of the audience, and
 - current.

Teachers should assess understanding of safety rules regularly, and document such instruction in the form of a safety contract. Students and their parents/guardians will sign this contract as soon as students join the class. (NOTE: the safety contract is also written in Spanish). Teachers will document that parents have reviewed the safety expectations through return of the signed contract, or through direct parent contact (by phone, email, or letter).

- 3) The teacher should identify and clarify any specific hazards involved with individual activities. This instruction should include:
 - proper handling and disposal of materials
 - possible (but realistic) hazards associated with each procedure
 - ways to prevent hazardous situations, and
 - the necessary course of action if a hazardous situation should occur.

Guidelines for Duty of Supervision:

- 1) The most effective way to prevent hazards in any classroom is with clear consistent standards of behavior, including consequences for infractions. Misbehavior and horseplay create an unsafe environment for all, and must never be tolerated.
- 2) Students must be supervised by a teacher or other authorized personnel at all times. This is particularly important in laboratory situations.
- 3) If the teacher is absent from school, laboratory work must not be left as a substitute lesson plan.
- 4) Materials for laboratory exercises should be stored securely away from the student areas when not in use.
- 5) The level of supervision must be appropriate to the age of the students, the degree of inclusion, and the hazardous nature of the work.
- 6) The teacher should ensure that students have adequate workspace and that all areas where students are working are accessible by the teacher.
- 7) Teachers are encouraged to attend training in the use of a fire extinguisher. This training is available through the Delaware Fire School. See the Science Supervisor for details.

Guidelines for Duty of Maintenance:

- 1) All chemicals will be properly labeled and prepared fresh. Teachers will follow Flinn Scientific guidelines (<http://www.flinnsci.com/Sections/Safety/labChemSafety.asp>) for proper use, storage and disposal of all chemicals. **Teachers should only prepare sufficient quantities of working solutions of chemicals to complete a given activity. At the end of the activity, surplus quantities of working solutions should be discarded if they will not be used in a reasonable amount of time.**
- 2) Teachers should monitor and arrange for necessary maintenance on apparatus used in student instruction. Defective equipment must either be repaired or discarded if repair is impossible.
- 3) Teachers and administrators should work together to keep safety equipment functioning properly. Safety equipment (e.g. fire extinguishers, safety showers) should be inspected and serviced annually or after use. Teachers should file written reports for maintenance or correction of any hazards or defects in the physical environment that might compromise safety directly to the building principal.
- 4) Fire extinguishers are inspected in each school annually. Teachers must communicate with the chief custodian to be sure all fire extinguishers are identified and inspected.

(Source: Science and Safety Making the Connection Council of State Science Supervisors.)

THE SCHOOL SAFETY PROGRAM AND TEACHERS' RESPONSIBILITIES

The most effective way to ensure adequate safety practices in the classroom is for safety instruction to occur throughout the year as an integral part of every activity.

1. A safety officer for each school should be identified early in the school year. This safety officer will be the point of contact in the building for all matters relating to chemical safety and science safety issues.
2. Teachers will introduce the safety program by providing students with a personal copy of the Laboratory Safety Contract that includes a list of *core* precautions to be used with students in all courses. Additional precautions that are specific to a course or a laboratory experiment may be added as needed.
3. Before any actual lab work begins, students should be instructed in emergency procedures, including evacuations.
4. Before beginning any activity, the teacher should review the particular safety rules and procedures most appropriate to the activity, and answer all student questions prior to beginning and monitor the students' activities closely.
5. Careful planning is expected for all activities. The following questions can be used to guide planning for a particular unit or activity.
 - What are the hazards?
 - What are the "worst case" scenarios and how can I prepare for them?
 - What practices, safety equipment, and protective facilities are prudent and appropriate?
 - Have I performed a "dry run" of the activity to prepare for any potential problems?
 - Is there adequate staff support to deal with unforeseen hazards?
6. Teachers should only conduct laboratory exercises that conform to district and state curriculum and instruction guidelines and to the Delaware Science Standards.
7. According to the Hazardous Chemical Information Act, all science teachers must provide training to students of their rights and responsibilities when working with hazardous substances. Teachers will obtain and keep documentation that students have received this instruction. Likewise, under this Act, teachers will be provided with annual training of these same rights and responsibilities.
8. Teachers should only conduct laboratory experiments when a school nurse or medical staff member is present in the building. If teachers are conducting an experiment after the school day (in preparation for later instruction), they should ensure that another teacher is present that is familiar with the risks associated with the procedure.
9. Teachers must report any injury that occurs during a laboratory exercise, however minor, to the school nurse immediately, and to the Science Supervisor in a timely manner. If a student is injured, the teacher should also contact the parent/guardian. Teachers may never administer medication (including topical agents or cough drops) to any student. If the incident is serious enough that the student cannot be moved, the teacher must summon the nurse and keep the area around the student clear. **Teachers are not to administer first aid to students unless the student's life is in danger. This applies to administering adhesive bandages for cuts. All situations requiring first aid must be handled by the nurse.** Teachers should never offer students bandages. NOTE: see exceptions to this section under [Field Trips](#) in this document.

10. Laboratory experiments should only occur in locations with adequate space. The amount of recommended space for a given activity may vary, but will depend on the following factors:

- The nature of the activity
- The overall design of the classroom
- The number, age, and special needs of the students

Teachers should advise administrators when there is insufficient space for safe laboratory instruction. In addition, the work area should be arranged so that the teacher may circulate around the classroom and supervise students. Compartmentalization (creation of small secluded workspaces) hampers the teacher from supervising students properly and can lead to improper laboratory behavior going undetected.

11. Teachers must ensure that appropriate laboratory apparel and etiquette are observed. In particular, certain lab activities may require the following::
- a. Safety goggles should be worn when certain labs with chemicals, glassware, or heat (hot plates or open flame) occur. Goggles that meet ANSI standard Z87.1 are appropriate for all of these situations, and are specifically required for certain chemistry labs. Contact lenses are not restricted.
 - b. Laboratory aprons should be worn during certain chemistry labs.
 - c. Protective gloves (vinyl or nitrile—NEVER LATEX) when students will handle bacterial cultures or preserved specimens. Laboratory workers should not eat, drink, chew gum, or apply cosmetics when working with chemicals or biological materials.
 - d. If open flames or high-speed motors are used, students with shoulder length hair should secure it behind their shoulders. In these situations, students should also secure loose fitting clothing and remove or secure dangling jewelry.
 - e. **Teachers are responsible for modeling appropriate laboratory etiquette. Modeling is the most effective teaching method. Also, visitors to the class (including administration) are required to use any precautions or safety equipment (e.g. goggles) required of students.**
12. Teachers should be aware of any health concerns of students that laboratory work may affect. These might include allergies, disabilities, temporary or chronic illnesses, or pregnancy. Teachers should work with the school administration, the school nurse, and the students' families to obtain current and accurate information. **Because of the increasing frequency and life threatening nature of latex allergies resulting from airborne latex particles, no activities involving latex balloons or latex gloves will be assigned. This restriction applies to both laboratory work and to teacher demonstrations.**
13. Teachers should report any hazardous or potentially hazardous conditions in writing to the head custodian and the principal immediately. Teachers should retain a copy of the report, and follow up with the progress of the report as needed until correction has been achieved. Until the hazard has been corrected, the teacher must suspend any laboratory work that could pose a danger to others as a result of the hazard.
14. Teachers must not leave students engaged in laboratory work unsupervised at any time for any reason. If the classroom must be evacuated during laboratory work, the teacher must ensure that no hazardous conditions exist before leaving the room.

15. Teachers must be sure that all safety equipment in the classroom is well maintained and easily accessible. In particular,
 - a. Desks should not block safety showers or eyewashes.
 - b. Fume hoods should not be used to store chemicals.
 - c. Classrooms must have immediate access to a class ABC fire extinguisher and a fire blanket. These should be in a location to allow access in 30 steps or within 15 seconds. Teachers should communicate with the chief custodian about the location of all fire extinguishers. **If a fire extinguisher is deployed at any time for any reason, the principal and the chief custodian must be notified immediately with all relevant details.**
 - d. Adequate ventilation appropriate for the laboratory exercise must be maintained. Any work that generates hazardous fumes should be performed in a functional fume hood.
 - e. Exits from the room must be easily accessible to all students, especially those with assistive devices (e.g. wheelchairs, walkers, crutches). The evacuation procedure must be explained to students before any laboratory work begins (preferably the first day of school), and special evacuation arrangements for students with assistive devices must be outlined and submitted to the principal.
16. Teachers are required to advise students of their rights and responsibilities relating to laboratory safety. Laboratory safety training must precede all laboratory work and become an integral part of the science curriculum. The teacher will obtain and keep documentation that students and parents have been informed of safety expectations.
17. Teachers must ensure that students clean up their work area after completing laboratory activities. In addition, teachers must be sure that students wash their hands after laboratory work or any time they must leave the laboratory area as needed.
18. **Teachers must never tolerate inappropriate behavior or unauthorized experiments in the laboratory.** One person's misconduct poses a hazard to everybody else in the laboratory. Students who engage in physical horseplay, sabotage of others' work, or unauthorized "experiments" must be removed from the laboratory immediately and properly disciplined according to the procedures in the Red Clay Student Code of Conduct (<http://www.redclay.k12.de.us/ps/index.shtml>). In addition, the offender's parent/guardian should be informed within 24 hours by the classroom teacher
19. The district's safety plan must be reviewed by all science teachers. Each classroom must post the evacuation procedure from the room and Emergency Response Guide (provided by the Coalition Science Specialist) in a prominent place. The Emergency Response Guide will include emergency procedures, special procedures (unique to each classroom situation as needed), and a list of emergency phone numbers. (Source: *Safety First, 2011*)

Good Samaritan Act

Any person, who in good faith gratuitously renders emergency care at the scene of an accident or emergency to a victim thereof, shall not be liable for any civil damages for any personal injury resulting from an act or omission by the person rendering the emergency care or as a result of any act or failure to act to provide or arrange for further medical treatment or care for the injured person, except acts or omissions amounting to gross negligence or willful or wanton misconduct. The exemptions from civil liability provided by this chapter shall not apply to the administering of such care where the same is rendered for remuneration or with the expectation of remuneration, or is rendered by any person or agent of a principal who was at the scene of the accident or emergency because he or his principal was soliciting business or performing or seeking to perform emergency care services for remuneration. (Source: 16 Del. C. 1953, #6801; 58 Del. Laws, c. 105; 59 Del. Laws, c. 361, #1.)

RESPONSIBILITIES OF THE SCHOOL SAFETY OFFICER (HIGH SCHOOL)

1. Act as liaison among science teachers, building and district administration, and facilities staff regarding science safety issues.
2. Maintain the science chemical inventory for the school, including the inventories of chemicals maintained by individual teachers. This inventory is updated annually (over the summer) and shared with the building principal, the chief custodian, the school nurse, and the District Science Supervisor.
3. Oversees and approves all chemical orders by the science department.
4. Maintain a supply of Material Safety Data Sheets (MSDS) for all chemicals in the science chemical inventory. Copies of these are shared with the building principal, the chief custodian, and the school nurse.
5. Assist teachers with maintenance requests related to safety equipment.
6. Assist District Science Supervisor with identifying and coordinating disposal of hazardous wastes.

ADMINISTRATORS' RESPONSIBILITIES

The school's administration needs to cooperate fully with science teachers to maintain a safe environment for laboratory investigation.

1. Principals need to ensure that the facilities for science instruction meet all requirements for safety. Although laboratory investigation is a crucial part of effective science instruction, a safe environment is an absolute prerequisite for laboratory investigation. This includes provision of fire extinguishers, fire blankets, and goggles with sanitizing goggle cabinets. Principals also need to ensure that chemicals are stored in secure storage facilities with limited access.
2. The number of students in a science classroom and the allotted space for laboratory work are crucial components of laboratory safety. As students are scheduled in science classes, administrators need to work with teachers and guidance counselors to ensure that science classes are small enough to allow adequate room for students to move easily and to allow teachers to supervise students safely.
3. Principals will not schedule science classes to routinely meet in classrooms that are not dedicated to science instruction. If such scheduling is necessary, the affected classes should have access to an appropriate laboratory on those days when students will conduct experiments.
4. Principals will not schedule teachers of subjects other than science to teach regular classes in science classrooms. If a hazardous situation involving science materials should occur, the teacher may not be equipped to intervene.
5. Principals must respond to maintenance requests that affect the safety level of the classroom promptly. If there is a delay in processing such requests, the principal should keep the teacher informed.
6. Administrators need to enforce appropriate disciplinary actions for safety infractions according to the severity of the infraction. If a student's behavior in the science laboratory poses a consistent safety hazard to that student and/or the rest of the class or school community, that student should be removed from science classes and appropriate interventions should be pursued.
7. Principals are expected to maintain an inventory of all chemicals on hand and the MSDS for each chemical.

RESPONSIBILITIES OF THE DISTRICT SCIENCE SUPERVISOR

1. Hold periodic safety meetings with a safety committee consisting of representatives from the following:

- Elementary School
- Middle School
- High School
- Nursing
- Custodial Services
- Administration
- District office

This meeting will address issues relevant to laboratory safety at the classroom level, the school level, and the district level.

2. Prepare and revise the district safety plan.
3. Provide annual safety training for all science teachers before laboratory instruction begins and keep records of training.
4. Maintain records of each school's chemical inventory, and provide schools with any necessary MSDS sheets. These inventories will be used to assist teachers with maintaining fresh chemicals and safely disposing of surplus chemicals.
5. Attend state level safety meetings and disseminate information from these meetings to district personnel as needed.
6. Assist teachers and administrators in meeting safety requirements as stated by law. This may include recommendations for space usage, finding safety resources for teachers, and arranging for disposal of hazardous surplus chemicals.
7. Coordinate with district communications officer with release of information to the public pertaining to science safety or science instruction.
8. Conduct yearly safety audits of teachers in the district to assess safety risks. The Science Supervisor will submit a written report of these audits to the building principals, building science safety officers, and district administrators as appropriate.
9. Coordinate collection of hazardous wastes from schools as necessary with a licensed waste hauler.
10. Obtain periodic (every five years) training as a chemical hygiene officer from a reputable source.

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CHEMICAL SAFETY

The following guidelines will be used in connection with science instruction involving chemicals and chemical apparatus.

Delaware Right-to-Know Law

Delaware's Hazardous Chemical Information Act (Right-To-Know Law) requires that all employees and students who may be exposed to hazardous chemicals be provided access to information regarding these chemicals effective January 1, 1985.

The Delaware Right to know law specifies three Rights (that the "employee/student" has) and three Responsibilities (that the "employer/teacher" has). The rights and responsibilities follow one from the other:

The student has the right to know:

1. What materials in their work environment are hazardous in any way.
2. How the materials are dangerous.
3. How to protect themselves against the hazards that the materials pose.

The teachers have the responsibility to:

1. Tell the students about any materials and procedures they will be exposed to that may be harmful to them in any way.
2. Inform the students of the exact nature of the hazards posed.
3. Teach the students how to protect themselves against the hazards posed by materials or procedures that they will be working with.

The chemistry laboratory is potentially the most dangerous place in the school. However, this need not constitute a serious threat if the instructor, laboratory assistants, and students have a thorough knowledge of the potential hazards, exercise prudent care and foresight, and use common sense. Accident prevention must be included in the performance of every task, and safety instruction must be an integral part of the overall program of science instruction. *Hazardous Chemical Information Act*, 64 Delaware Laws, c. 344 § 1.

Specific considerations for chemistry safety:

Chemical information

1. All chemicals provided to students for use must be in a clearly labeled container. This rule applies to all chemicals regardless of hazardous nature.
2. Labels on individual reagent containers for student use containing less than 100 ml must contain certain identifying information:
 - Name or chemical formula of the reagent
 - Concentration (if in solution)
 - Date of preparation if possible
3. In some cases, reagent bottles may be labeled with a letter or number (for example, if the reagent is an unknown for identification). The teacher will have an identification key for the unknowns and will provide hazard information about the unknowns to the students before work begins. When the lab exercise involving the unknown reagents is over, the bottle will be labeled with the name of the reagent.

4. Before purchasing new chemicals, teachers will check the chemical inventory in their building to assess the need for the purchase. The following will be considered **before** purchasing chemicals:
 - Will amounts be used within 1-2 years?
 - Can the chemical be stored properly?
 - Can the chemical be disposed of easily?
 - Are there appropriate and sufficient safety apparatus and personal protective equipment for using this chemical?
 - Is the teacher properly trained to use this material? Is use of this chemical age and grade appropriate?
5. Upon receiving new chemicals, teachers will write the date (including year) of receipt and the date the bottle is opened on the manufacturer's label. The teacher will also retain the Material Safety Data Sheet (MSDS) that arrives with the chemical.
6. The MSDS contains detailed information of all hazardous information about a chemical. Manufacturers of chemicals are required by law to ship a current MSDS with every chemical. The collection of MSDSs for all chemicals held by the school should be provided to the principal and the school nurse. Additionally, the collection should also be kept in the chemical storage area. Teachers can obtain MSDSs from the chemical manufacturers or from the Science Supervisor.
7. Certain chemicals are not permitted for use in k-12 science classrooms (see Appendix A). In particular, mercury and mercury compounds must be removed from schools by January 1, 2005. This includes mercury thermometers and mercury barometers. Any of these that are found must never be used in laboratory exercises. Schools should contact the Science Supervisor if these are found in buildings.
8. Schools and teachers are not to accept donated chemicals from industry or other institutions of learning without the express permission of the Science Supervisor, especially if the container has been opened. Because of evaporation or hygroscopy, the purity of such chemicals cannot be guaranteed. Furthermore, transporting such chemicals may constitute a hazard. Any chemical orders must be pre-approved by the building Safety Officer.
9. When combining water and any acid, always add small amounts of the acid to the water. Adding water to the acid can result in splashing of the acid, leading to a corrosive condition.
10. Glass should be handled with care. All glassware that students handle should be fire polished whenever possible. Students should use particular care in handling microscope slides and cover slips (which cannot be fire polished). Only teachers should insert glass tubing into rubber stoppers. Pipetting must be done using a bulb or other suction device—**mouth pipetting is expressly forbidden.**
11. Student aides must never prepare chemicals for classroom instruction, nor are they permitted to enter chemical storerooms.

(Source: Safety First, 2011, Furr, 2000)

Chemical Storage

1. Schools must take inventory of all chemicals annually. Inventories should be conducted by at least two adults at a time. Students should not assist in this process. The inventory should contain the following information:

- name of the chemical,
- physical state of the chemical (e.g. crystals, powder, aqueous solution)
- amount on hand,
- date purchased (if known)
- location on where the chemical is stored,
- a “sign out/sign in” procedure for when chemicals are used

Copies of the inventory should be furnished to all teachers using the stored chemicals, the school nurse, the principal, and the district Science Supervisor.

2. Chemicals should be stored in a dedicated room with limited access. Only teachers who use the chemicals for instruction, the custodial staff, and the principal should be granted unlimited access. **STUDENTS SHOULD NOT BE PERMITTED IN THE CHEMICAL STOREROOM AT ANY TIME.** The room should be well ventilated, well lighted, and be equipped with ceiling mounted smoke detectors, ABC fire extinguishers, and be close to intercom or telephone access to the main office.
3. Chemicals must be stored according to chemical compatibility. The chemical storage pattern described by Flinn Chemical Catalog is recommended.

http://www.flinnsci.com/Sections/Safety/chemicalSafety/L1070-1074_HS_ChemInvenStor.pdf.
4. Certain chemicals (acids, flammables, strong oxidizers) must stored in dedicated labeled cabinets.
5. The shelving in the chemical storeroom should be clearly labeled with the families of chemicals stored (e.g. sulfates, halides, carbonates). If any water appears on shelving in the chemical storeroom, the chemicals should be removed from the shelf and the problem identified and corrected immediately.
6. Chemicals should never be stored above eye level nor on the floor. Teachers should not climb ladders or furniture to reach chemicals. If the desired chemical is out of reach, obtain assistance or have the chemical moved.
7. Refrigerators that contain chemicals must never be used for food, and vice-versa. All refrigerators should be inventoried monthly and cleaned as needed.
8. Schools should communicate with one another and with the Coalition Science Specialist about their chemical needs. Occasionally, one district school will have an abundance of a chemical that is not needed while another school is out of the same chemical. If the chemical is in good condition and transportation is possible, the Science Supervisor may be able to facilitate re-distribution of the chemical. However, schools must never accept any chemical without a matching MSDS sheet.
9. When chemicals are used in student laboratory exercises, the students should not use the stock bottles. Instead, place sufficient chemicals into labeled beakers for student use. Excess chemicals should never be returned to the stock bottle as this could compromise the purity of the stock and possibly cause a dangerous reaction with impurities from the lab. Chemicals should not be stored in classrooms as a general rule.
10. Chemicals and solutions should only be stored in proper chemical containers. Homemade bottles (e.g. baby food jars, soda bottles) may not provide adequate protection for the chemical. The integrity of bottle closures should be checked during the chemical inventory and chemicals with compromised closures (e.g. cracked lids, “frozen” ground glass stoppers) should be discarded.

(Source: *Flinn Chemical & Biological Catalog/Reference Manual*, 2011)

Chemical/Waste Disposal:

1. Schools should only retain enough of any chemical to be used in 1-2 years. Unless there are specific plans to use surplus chemicals in a reasonable period of time, they should be discarded.
2. Teachers discarding chemicals need to pay close attention to proper disposal procedures as outlined on the MSDS.
3. Solid waste should never be discarded in the sink. Even if it is water soluble, the solid can clog the drain.
4. Some chemicals must be discarded using special disposal procedures or a licensed hazardous waste removal company to avoid creating an environmental hazard. Contact the district Science Supervisor for guidance.
5. When disposing of several chemicals at once, be aware that different chemicals may have unexpected reactions when combined in the sink.
6. If the label has disappeared from a chemical and it cannot be identified, assume it is hazardous. Contact the Science Supervisor.
7. Broken glass should be discarded in a labeled box made of hard plastic or corrugated cardboard. The box should be taped shut and disposed of carefully. Again, be mindful of what chemicals (if any) are on the broken glass before discarding. Students should not attempt to clean up broken glass—they should call for the teacher's assistance.
8. It is suggested that at the end of the school year, all working solutions of chemicals be properly discarded and the reagent bottles cleaned. Besides ensuring that students will work with the best quality materials possible, this practice will minimize problems associated with surplus chemicals. From year to year, teachers change teaching assignments, labels fade or deteriorate, and solutions dry out. After many years, it becomes impossible to remember what was in a particular bottle.

Other considerations:

1. Be sure that any time students work with chemicals, there is adequate ventilation. Many reactions produce unpleasant odors. While these odors may not necessarily be toxic, they could be strong enough to irritate mucous membranes or cause an adverse reaction.
2. Students are never permitted to bring chemicals into the hallways.
3. Teachers should only provide sufficient chemicals for a given experiment and avoid providing excess chemicals to classes. When possible, choose activities that employ micro-quantities of chemicals.
4. Spilled water on the floor is one of the most hazardous chemicals in the lab. Anybody can easily slip in a puddle because it is frequently difficult to see. Impress upon students the need to identify and clean spilled water immediately.
5. Certain laboratory activities in grades K-8 require the use of a tea candle as a heat source. In this situation, students must tie back shoulder length hair and secure dangling clothes or jewelry. Other than these cases, open flames should not be used as a heat source in a lab in grades K-8. Hot plates and water baths should be used for heating in these grades.
6. When heating glassware, it is important to remember that hot glass looks exactly like cool glass. Use appropriate equipment to handle hot glass (e.g. tongs, test tube holders). Safety goggles must be worn in the lab when glassware is used.

7. Lab activities that involve open flames should not be attempted before 9th grade (other than as described above). When science classes use laboratory gas burners, extreme care must be exercised. The hottest part of the burner is the space immediately *above* the flame. The flame should only be extinguished by turning the gas jet handle (in the “off” setting, the handle is perpendicular to the jet). The teacher must know the location of the master shut-off button for the gas jets in the room. Laboratory burners and hot plates should **never** be used as a way to heat a cold room.
8. When liquids are heated in a test tube, the opening of the test tube must be pointed away from all others. The teacher should work with students to ensure the optimum work arrangement to allow this to happen.
9. The student workplace must be uncluttered. The only things students should bring to the laboratory workstation are the materials needed to do the activity.
10. Teachers need to prepare designated containers for disposal of wastes according to hazard information. Lesson planning must include proper disposal of all chemicals and refuse. Waste containers should be disposed of promptly—no laboratory waste should be retained longer than three weeks, regardless of its hazardous nature.
11. Sometimes chemicals may be identified by a characteristic smell. The only correct way to smell a chemical is to hold it a few inches away from the nose and waft the fumes of the chemical toward the nose. Any other method of smelling a chemical can irritate the mucous membranes of the upper sinuses and the eyes. **TASTE MUST NEVER BE USED TO IDENTIFY A CHEMICAL.**

(Source: *Safety First*, 2011)

BIOLOGICAL SAFETY

The following guidelines will be followed in connection with science instruction involving biology and life sciences.

Use of animals

1. Live animals can be used in a variety of situations in science classes at all levels. Animals should be obtained from a reliable biological supply center (e.g. Carolina, Wards). Students' pets should never be the subjects of experimentation, and wild animals should not be brought into the classroom.
2. The teacher is responsible for providing the animal with appropriate living quarters. This includes ensuring adequate sanitation, protection from adverse conditions, temperature regulation, proper feeding and watering regimens, and provision for offspring. Care must be taken to prevent the animal's escape. If the animal should escape, the principal and the head custodian should be notified immediately and every attempt to recover the animal should be made.
3. If live animals are maintained in a classroom, the teacher must make provisions for the animals feeding and cleaning for when school is closed, especially over several days.
4. If students are required to handle the animals, they should wear vinyl or nitrile gloves and wash their hands after handling the animal. As all animals may bite, students should be thoroughly instructed on safe and humane care of the animal. If a student is bitten, the nurse must be notified (as with any laboratory accident or injury), and the offending animal isolated for further examination.
5. If an animal becomes ill or dies unexpectedly, an animal care professional should examine the situation to confirm whether a zoonotic disease (an animal disease that can be contracted by humans) was involved. Care must be taken to remove animal corpses and animal excreta safely and humanely.
6. Euthanasia of animals should only be conducted as follows:
 - a. Euthanasia should only be carried out by an adult and only after the activity had ended. It should not be performed in the presence of students. Euthanasia should not be part of an ongoing laboratory activity.
 - b. Only invertebrate animals and fish should be euthanized by the teacher. Other arrangements should be made for other vertebrates. Unwanted live laboratory animals should never be released to the wild or given to students as pets.
 - c. Euthanasia should be performed safely and humanely. Animal corpses should be double bagged and disposed of in approved manner so that no environmental risk is introduced.
 - d. Insects must not be euthanized with diethyl ether.
7. Certain animals must never be used in a science classroom. These include (but are not limited to)
 - Ants
 - Stinging insects (bees, wasps, hornets)
 - Poisonous spiders
 - Disease vectors (mosquitoes, ticks, fleas)
 - Venomous snakes (note: non-venomous snakes may be kept in a science classroom with the principal's permission.)
 - Scorpions
 - Aggressive carnivorous fish (piranha)
 - Exotic species (plant and animal) known to endanger local ecosystems (e.g. Japanese beetle, Northern Snakehead, kudzu)

Use of preserved animals

1. Animals for dissection must be preserved in a non-formalin containing preservative only. Any animals that have been preserved in formalin or formaldehyde containing preservatives are discarded as a chemical hazard (contact the Science Supervisor). Formaldehyde is a suspected carcinogen.
2. Only preserved animals that have been purchased from a biology supply company should be dissected. Never allow students to dissect animal corpses found in the wild. Decaying animal remains should never be dissected, even if they have been appropriately preserved.
3. Dissections should only be performed in rooms with abundant ventilation. The animal should be washed thoroughly with water before cutting. Once the initial incision is made, the internal organs should be rinsed thoroughly with water.
4. Students performing dissections must wear appropriate safety equipment:
 - a. Laboratory apron
 - b. Vinyl or nitrile gloves
 - c. Safety goggles
5. Only scalpels may be used to cut the specimen—bare razor blades provide inadequate control while cutting. Dissecting instruments must be sharp. The teacher must maintain close supervision of students and account for all dissecting apparatus before and after the lesson.
6. Teachers should remind students of possible adverse occurrences during a dissection (dizziness, anxiety, cuts, skin irritation from preservative, cuts, allergic reaction), and assess students for any signs of these occurrences.
7. Teachers are advised to use effective grouping strategies during dissections. Only one group member should handle the specimen and dissecting instruments at a time.
8. Incisions should always be made away from the student and away from other group members.
9. Some students are unable to participate in animal dissections for a variety of different reasons. Students must be given the option of completing an alternate activity for full credit in lieu of a dissection.
10. All dissected parts must remain in the dissecting tray until they are discarded. Before performing a dissection, the teacher should consult with custodial services for directions on proper disposal of remains.

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Use of plants

Plants and plant parts provide a convenient and rich source of living data for laboratory science. Certain safety protocols apply to using plants in science instruction.

1. Before starting any work involving plants or plant products, teachers need to determine what allergies students may have. Students should never work with any material for which they have exhibited an allergic reaction. Teachers should be aware of the symptoms of an allergic reaction (see <http://www.aaaai.org/patients/publicedmat/tips/whatisanaphylaxis.stm>)
2. Laboratory exercises involving horticulture performed in the classroom should be done with sterilized potting soil. Naturally occurring soils frequently contain molds, parasites, stinging insects, or other hazardous impurities.
3. Cultivated plants should be well cared for and given plenty of room to grow. Sick or overcrowded plants tend to become breeding grounds for molds, which can present an allergic or respiratory hazard in the classroom. Bringing plants (including seeds) from the wild for cultivation is discouraged because of the risk of disseminating molds. Plants and seeds should be purchased commercially.
4. When working with flowering plants, take care to avoid dispersing large amounts of pollen. This can trigger an allergic reaction in some people even if such a reaction has never occurred before.
5. Plants that are known to be poisonous or extremely allergenic should never be brought into a classroom. When students conduct laboratory investigations outside, they should be instructed to recognize potentially hazardous plants growing indigenously, such as poison ivy, poison oak, stinging nettle, and jimsonweed. Students should never taste any plant or fungus growing outside. Many plants are extremely poisonous if ingested (e.g. toadstools, buttercup, azalea). In addition, plants may have been sprayed with insecticides, or have been exposed to animal waste. Any incidence of jimsonweed growing on or near school property should be reported to the principal and the Delaware Department of Natural Resources and Environmental Control (DNREC) immediately. Appendix B shows the appearance of these plants.
6. Any and all tobacco demonstrations, including those relating to the components of tobacco smoke, are forbidden.

(Source: *Safety First*, 2011)

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Use of microorganisms

1. Microorganisms used for study in the K-12 science laboratory must be Biosafety Level 1 and be obtained through commercial vendors. Random sampling of school environments to obtain representative microorganisms is not to be practiced. The consequences of culturing a human pathogen warrant that environmental culturing of microorganisms should be discontinued. Microorganisms should never be cultured from a human or animal source (e.g. throat culture). Whenever possible, the least hazardous microorganism should be used for a procedure (e.g. *Saccharomyces cerevisiae* can be used to demonstrate the streak plate method of inoculation and smear preparation).
2. Correct aseptic technique must be demonstrated and modeled before students work with microorganisms. Students should practice all techniques with sterile materials before handling microorganisms.
3. The following terms apply to control of microorganisms:
 - Sterilization: killing all living organisms in an environment, including microbial spores
 - Disinfection: killing most (not necessarily all) microorganisms (usually from skin or an inanimate surface)
 - Sanitization: reduction of numbers of microorganisms to safe levels (i.e. kitchen sanitization)
4. Culture media that are used to grow microorganisms must be steam sterilized at 121° C and 15 psi for at least 15 minutes before use. Equipment for culturing may be sterilized in the same way or by incineration. Culture media that have supported growth of microorganisms should be sterilized at 121° C and 15 psi for at least 30 minutes before disposal. If this is not possible, the cultures must be saturated with chlorine bleach for 60 minutes before disposal. NOTE: immersion in bleach is considered disinfection, not sterilization. Students are not permitted to operate steam sterilizers (autoclaves or pressure cookers). This applies to student aides as well as other students.
5. Culture media must be clearly labeled with the type of media (this can be done with color coded caps on culture tubes and stickers on Petri plates as long as a legend is readily accessible), the source of the inoculum, name of the organism (if known), the student's name, and date of inoculation. If the sterility of the culture medium is questionable, it should be considered contaminated and sterilized immediately.
6. Students working with microorganisms should wear appropriate apparel at all times. This includes safety goggles, lab aprons, and vinyl or nitrile gloves. Because this work may involve using laboratory burners, hair that reaches the shoulder should be tied back. Students must wear closed toed shoes when working with microorganisms.
7. If a culture is spilled on student belongings, the contaminated items must be disinfected. Saturating the items with chlorine bleach for 10 minutes constitutes adequate disinfection. Students are encouraged to wear old clothes on days they will work with microorganisms. Students should never clean up culture spills. The area of the spill should be quarantined until the teacher can decontaminate it.
8. If a culture spill occurs on a student's skin, the student should wash the affected area for five minutes with antimicrobial soap. The school nurse must examine the area immediately.
9. If the culture spill occurs in the eyes or any mucous membrane, the affected area should be rinsed using the eyewash for 15 minutes. The nurse must be brought to the classroom immediately to assess the incident.

10. If a culture or Petri plate containing colonies of microorganisms is observed by students, the closure should be taped shut. Because of the risk of dropping or breaking culture tubes and Petri plates, teachers should not pass cultures around the classroom for inspection. Rather, the cultures should be set up at lab stations and students should move from station to station to inspect the cultures.
11. Any culture that develops mold (evidenced by powdery or cottony growth called hyphae) should be taped closed and discarded immediately. Molds and mold spores can cause severe respiratory symptoms. They spread quickly throughout a school and are difficult to remove.
12. Inoculating loops and needles must be sterilized in a laboratory burner until they glow orange for five seconds before and after inoculation. Because of the possibility of creating contaminated aerosols, the loop or needle must be cooled for approximately ten seconds before use. Students should not cool a hot loop or needle by immersing it into a sterile part of an agar plate. Alcohol burners pose a fire hazard and should not be used to sterilize inoculating equipment.
13. Glass spread bars ("hockey sticks") should be steam sterilized in a sealed bag and used once before disinfection in chlorine bleach. The practice of dipping the bar in 70 % isopropyl alcohol then flaming it is not a reliable sterilization procedure and it creates a fire hazard.
14. Biohazardous waste requiring sterilization must be placed in a bag with a biohazard label. The bag should be sealed and sterilized when it is half full. The biohazard bag should be sealed when not in use and sterilized within a week from when waste is first introduced to it.
15. Because of the possibility of infectious conjunctivitis ("pink eye"), microscope eyepieces should be disinfected by wiping with 70 % isopropyl alcohol after use. Students suffering from infectious conjunctivitis should not come to school until cleared by a physician.
16. Refrigerators that contain specimens used for scientific study must never be used for food, and vice-versa. All refrigerators should be inventoried monthly and cleaned as needed.
17. Teachers will not conduct laboratory activities that involve drawing blood or involve other human body fluids.
18. Teachers may conduct laboratory exercises involving microscopy of epithelial cheek cells. Only toothpicks or (preferred) clean wood splints may be used to obtain cells. Any items used to collect cells are considered contaminated—students must not drop these in the trashcan or lay them on the lab bench. Sampling devices must be decontaminated (immersion in 10 % bleach solution overnight) or sterilized before being discarded. Glass slides used to view epithelial cheek cells should be decontaminated in 70 % isopropyl alcohol for ten minutes prior to being discarded.

(Source: *Safety First*, 2011, *Flinn Chemical & Biological Catalog/Reference Manual*, 2005)

PHYSICAL SAFETY:

Heat and Fire:

1. Tea candles may be used in some laboratory activities in elementary science classes. No other forms of open flames should be used as a heat source in any procedures before ninth grade. Candles should be lit with spark lighters.
2. Safety goggles must always be worn in a laboratory where a heat source is used.
3. Students must be instructed that heat sources, hot glassware, and live steam can cause severe burns on exposed skin. If open test tubes are being heated, they should be pointed away from all others.
4. Only borosilicate (e.g. Pyrex™ or Kimax™) glassware should be heated. Heated glassware must never be handled with bare hands, regardless of how long it has been heated. Use tongs or insulated gloves. Never heat cracked glassware, as the item is likely to shatter along the crack.
5. Shoulder length hair must be tied back whenever an open flame is used (including lit tea candles). Never leave a flame unattended.
6. Bunsen burners should be lit with spark lighters, not matches or butane lighters. The gas line should be inspected for cracks or holes before use. The spark lighter should be ready to use as soon as the gas jet is engaged, to prevent harmful accumulation of gas in the room. Burners should only be extinguished by turning off the gas jet.
7. The teacher must know the location of the automatic shutoff valve for gas. Hot plates and gas jets should be checked at the end of laboratory work to be sure they are in the "off" position.

Electricity:

1. Prior to using any electrical equipment, teachers should carefully read the manufacturer's instructions. Teachers conducting labs or demonstrations with electrical equipment should be familiar with the dangers of electrical shock and its treatment. The best treatment is to avoid the situation through good safety procedures.
2. When working with electrical equipment, only tools with properly insulated handles should be used. Metal articles such as rulers, pencils, pens, or probes should never be used to examine circuits. Students should remove rings, bracelets and any jewelry that might contact a live circuit when doing electrical work.
3. All electrical equipment having voltages exceeding 50 V should be grounded or be made of approved "double insulated" design. Grounded appliances are equipped with a three-prong plug and should never be operated with the ground plug removed or inoperative. This type of plug should not be used with a common two-prong receptacle. All receptacles should be grounded in science classrooms.
4. The use of extension cords in the laboratory should be minimal. They should be considered a temporary measure and sufficient receptacles installed to replace them in permanent or frequent applications. When used, they should be of three prong grounded design unless used with "double insulated" equipment. Since grounded extension cords can be used with all equipment, it is recommended that they be the only type used in science labs. Since electrical resistance increases with the length of the cords and because of the dangers of creating a physical hazard in the classroom, extension cords should be as short as possible.

5. **Batteries:** When working with batteries students should be advised of the dangers involved. Few students are initially aware of the dangers that can be created by cells in series (high voltage) or in parallel (high current). Teachers should be aware of the number of batteries available and of the potential for unauthorized experimentation. The following cautions should be reviewed with the students as appropriate to the activity.
 - a) Experiments in electricity should be designed so that the total voltage is less than 50 volts.
 - b) Short circuits and parallel circuits create a fire hazard due to the high currents present. Some batteries may cause a fire hazard if short-circuited.
 - c) Steel wool can be ignited by accidental short circuits and should never be stored with batteries.
6. Any time students are creating a circuit, they should draw a diagram first to identify possible short circuits. If possible, turn off all power when working on electrical equipment. The power leads should be the last connection made when assembling equipment and the first disconnected when disassembling equipment.
7. Students should be trained to use one hand when working on high voltage circuits as much as possible. They should be cautioned against having one hand on a grounded circuit or chassis and accidentally contacting a high voltage source with the other. Electrocutation is a real possibility in this case.

Light/electromagnetic radiation:

1. **Lasers:** The Federal Government has issued Laser performance standards and lasers are classified by power output. The manufacturer's cautions should be followed. The helium-neon lasers of class I and II commonly found in schools are believed to offer no hazard to human skin but could cause eye damage at power levels above 1.0 milliwatt. In demonstrations, particular care must be taken so that neither the direct beam nor any mirror-like reflections strike the observer's eye since the beam could be focused onto the retina. Students should never be permitted to carry or use personal laser pointers except when they are part of a lesson and supervised by the teacher.
2. **Sunlight:** Direct vision of the sun for even short periods of time can cause eye damage. Mirror-like reflections may also cause injury to the eyes. Sunglasses and exposed photographic film do NOT provide sufficient filtering power to reduce sunlight to safe levels. In fact, they may increase the injury caused by the sun by dilating the pupils of the eye while not blocking sufficient light, particularly in the Ultraviolet range. If experiments are done to observe the sun, they should project an image on white paper using a lens or "camera obscura". Measurements or observations can be made on the paper. Students should be educated on the dangers of staring at an eclipse of the sun (partial or total).
3. **Ultraviolet radiation:** Proper shielding or goggles certified for ultraviolet protection are required. The teacher should be aware that a wide UV spectrum exists and that protective glasses must be matched to the source.

(Source: *Safety First*, 2011)

FIELD TRIPS:

The teacher can and should exercise direct control over student science activity in the classroom. However, many worthwhile and desirable science activities can occur outside the classroom and should be encouraged. Safety consciousness, instilled as part of the science instruction program, should influence these outside activities.

1. **All Red Clay Consolidated School District policies regarding field trips must be followed:** Prior to departure on a field trip, the teacher should issue "Field Trip Permission Forms" to each participating student. These forms must be signed by the parent or guardian and returned prior to the trip. These permission slips, as the name implies, give parental approval for the student to make the trip, but in no way diminish the teacher's responsibility for safeguarding the students.
2. **Emergency Cards:** Important information regarding a student's state of health, medical problems, medication, allergies, phone numbers, etc., can be found on the Emergency Cards filed with the nurse. A teacher should have this information available when going on a field trip, as well as a copy of approved emergency procedures, available in the School Nurse Handbook.
3. **Transportation:** Transportation will normally be furnished by school buses. If none are available, commercial buses may be used. There must be an adult, teacher or parent, in charge of the students in each bus. **Teachers will not use private automobiles to transport students for field trips.**
4. **Trips to wilderness areas:** On biology or geology field trips to wilderness or undeveloped areas, the following special precautions should be taken:
 - a. **First aid:** The teacher in charge must be trained in First Aid and equipped with a First Aid kit. CPR training is also recommended.
 - b. **Clothing:** Students should be required to wear appropriate dry shoes and clothing suited to the weather and terrain.
 - c. **Mosquitoes and Ticks:** If the trip is taken during mosquito/tick season, the clothing should be "pest-proofed" as much as possible (long pants, long sleeved shirts, buttoned collar, wrist and ankle bindings). Head coverings should also be worn. Proper insect repellents should be used at all times. Students need to inspect themselves for ticks before retiring.
 - d. **Animals and Plants:** Students should never approach any animal discovered in the wild. They are invading the animal's habitat, and the animal may react dangerously. Mammals in the wild may carry rabies. Students should also never go near animal carcasses. The animal may not be dead, and the cause of death cannot be known for certain. Teachers must remind students not to collect unauthorized specimens nor to leave any refuse (trash) behind at the field trip site. Students should be briefed on the appearance of hazardous plants and animals in the vicinity.
5. **Supervision:** There must be one adult chaperone for every ten students on a field trip. One adult must be trained in first aid and maintain all medicines required by students. Students should travel in pairs or in groups and agree on a rendezvous place and time.

(Source: *Safety First*, 2011)

(Supports Red Clay Administrative Memorandum on Field Trips)

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OTHER CONSIDERATIONS:

Many other issues and considerations relevant to science safety are likely to arise in any given teaching situation. Teachers and administrators are encouraged to discuss and explore these and other safety concerns in department meetings, faculty meetings, and in other appropriate discussion forums. Teachers also need to maintain a regular ongoing discussion about safety with their students throughout the year.

If particular problems or concerns develop, teachers are encouraged to speak to their building safety officer (or science lead teacher), their building administrators, or the District Science Supervisor.

Science teachers who wish to conduct new or unusual laboratory investigations with their classes must first discuss their plans with the building safety officer, the building principal, or the Science Supervisor, to determine if the activity can be performed safely in the school setting. This is particularly important if extra materials are required.

LABORATORY SAFETY CONTRACT
Red Clay Consolidated School District

Student's name: _____

School: _____ Grade: _____ Date: _____

Science is an active, hands-on process. Every precaution is taken to make the laboratory a safe place to work. However, because of the serious consequences of mistakes or carelessness, safety can only be assured by complete cooperation and compliance with instructions. To ensure a safe learning environment, all students will be instructed in science safety, take a science safety quiz, and both parents and students will sign this contract. Copies of the signed contract will be kept by the student, the parent/guardian, the teacher, and the school.

1. Students will act responsibly in the laboratory at all times. Running, horseplay, and pranks are unsafe and will result in removal from class and disciplinary action.
2. Students must follow all directions, both written and spoken about laboratory procedures, safety precautions, and cleaning up. Students will dispose of all waste materials according to the teacher's instructions.
3. Students will wear proper clothing in the lab according to the teacher's instructions. This may include safety goggles, lab aprons, or gloves. Shoulder length hair, loose sleeves, and dangling jewelry must be tied back when using open flames or high-speed motors. If laboratory work involves caustic, corrosive, or hot chemicals, shoes should be closed toed .
4. Students must not eat, drink, chew gum, or place anything in the mouth in labs where chemicals are being used. Tasting chemicals is forbidden, even if the chemical is edible.
5. Unauthorized experiments are prohibited. Students may not remove equipment or supplies from the lab unless authorized by the teacher.
6. Students will know the locations of safety equipment and emergency exits. Students will notify the teacher of any hazardous condition or damaged equipment. Students should work together to maintain a safe environment, but they must wait for direction from the teacher before correcting a hazardous situation.
7. Students will clean up after themselves. The workplace should remain neat and clutter free.
8. Students will use exceptional care when working with heat or electricity. Electrical appliances should only be handled with dry hands. Hot glassware should not come in contact with cold liquids. Open flames must never be left unattended. Heated items should be handled with appropriate apparatus (such as tongs or insulated gloves), never bare hands.
9. Students must adhere to all safety precautions concerning chemicals. Test tubes must be pointed away from others, especially when they are being heated. Always add acid to water rather than water to acid to prevent splashing of corrosive acid.
10. If the room must be evacuated, close all containers and turn off any gas jets, electrical appliances, and water sources (in that order).

By signing below, I understand and agree to follow all of the safety rules in this contract. I also understand that other safety rules may apply to specific classroom activities that are not listed in this contract. I will follow these rules as well and will follow common sense at all times. I am aware that any safety violation that results in unsafe conduct or misbehavior on my part may result in my removal from the classroom and/or further disciplinary action.

student signature

parent signature

SCIENCE SAFETY INSPECTION CHECKLIST

The safety checklists in this appendix were adapted from
Science Safety: Making the Connection, Council of State Science Supervisors, 2000

GENERAL SCIENCE-SAFETY CHECKLIST

School _____ Date _____

Room Number(s) _____ Teacher _____

Type of Activity _____ Evaluator _____

Directions: Circle the appropriate choice for each item on the checklist:

S = Satisfactory (item meets guideline, no action needed)

U = Unsatisfactory (item does Not meet guideline, corrective action required)

NA = Not applicable (item does not apply for this room or activity)

The following general science-safety recommendations are followed:

1. Have appropriate protective equipment:

a. safety goggles	S	U	NA
b. chemical aprons	S	U	NA
c. non-allergenic gloves	S	U	NA
d. eyewash	S	U	NA
e. shower(s)	S	U	NA
f. ABC fire extinguisher	S	U	NA
g. fire blanket(s)	S	U	NA

Items d-f must have accessibility within 15 seconds or 30 steps from any location in the room. Make certain that instructor and students wear adequate protective equipment, including especially safety goggles and aprons, when experiments involving hazardous chemicals or procedures are conducted.

S U NA

2. Notify supervisors immediately of hazardous or potentially hazardous conditions, such as lack of Ground-Fault Interrupters (GFIs) near sinks, inadequate ventilation, damaged or missing safety equipment, or unsafe use of facilities (e.g. scheduling non-science classes in science rooms)

S U NA

3. Check the fume hood regularly for efficiency and never use the hood as a storage area. Ensure that the hood is vented properly through the roof.

S U NA

4. Use only equipment in good condition (not broken) and efficient working order.

S U NA

5. Have separate disposal container for broken glassware and flammables.

S U NA

2. Discuss and post emergency/escape and notification plans/numbers in each room/laboratory. Clearly mark fire exits, and keep exits (preferably two from laboratories) unobstructed.

S U NA

7. Keep documentation of a safety contract with students and parents and enforce its provisions.

S U NA

9. Model, post, and enforce all safety procedures.

S U NA

10. Keep laboratory uncluttered and locked when not in use or when teacher is not present.

S U NA

11. Know and follow district and state policies/guidelines for use of hazardous chemicals, live animals, and animal and plant specimens in the classroom/laboratory.

S U NA

12. Keep records on safety training and laboratory incidents.

S U NA

3. Provide the number of accessible lab stations having sufficient workspace and low lab table sections for wheelchair accessibility that can be supervised by the number of qualified teachers present.

S U NA

Highest student:teacher ratio for this teacher : _____

4. Have master cut-off switches/valve within each laboratory (preferably in one secure location); know how to use them; and keep water, gas, and electricity turned off when not in use.

S U NA

5. Maintain up-to-date chemical and equipment inventories, including Material Safety Data Sheet (MSDS) files. These lists are also in offices of the principal, chief custodian, and school nurse.

S U NA

16. Label equipment and chemicals adequately with respect to hazards and other needed information.

S U NA

6. Post the National Fire Protection Association (NFPA) "diamond" at all chemical storeroom entrances denoting the most hazardous chemical in each category within. Regularly send an update copy of the inventory to the local fire department.

S U NA

18. (High school only) Organize chemical storerooms properly. Arrange chemicals by Flinn chemical compatibility codes, with special storage available for oxidizers, non-flammable compressed gases, acids, and flammables.

S U NA

7. Store chemicals in appropriate places e.g., below eye level, large containers no higher than 2 feet (.6 meters) above floor, acids in corrosives cabinets, and solvents in OSHA approved flammables cabinets-with acids physically separated from bases and oxidizers physically separated from organics within secure, limited access adequately ventilated storerooms

S U NA

20. Provide in a readily accessible location appropriate materials and procedures for clean-up of hazardous spills and accidents, e.g. vermiculite and baking soda for acids, Chlorine bleach solution for body fluid, and appropriate procedures for disposal of chemical and bio-hazardous materials.

S U NA

8. Prohibit the use of pathogens or any procedures or materials in any school; laboratory above Bio-safety Level 1 as outlined by Centers of Disease Control/National Institutes of Health protocols.

S U NA

Comments: Please refer to specific item numbers.

CHEMICAL PURCHASING, LABELING, STORAGE AND DISPOSAL CHECKLIST

School _____

Date _____

Room Number(s) _____

Teacher _____

Evaluator _____

Directions: Circle the appropriate choice for each item on the checklist:

S = Satisfactory (item meets guideline, no action needed)

U = Unsatisfactory (item does Not meet guideline, corrective action required)

NA = Not applicable (item does not apply for this room or activity)

The following purchasing, labeling, storage, and disposal recommendations are as follows:

A. Purchasing

These factors are considered before purchasing

1. Will the amounts be used within 1-2 years?

S

U

NA

2. Can the chemical be stored properly and disposed of safely?

S

U

NA

3. Does the facility has proper personal protective equipment?

S

U

NA

4. Are facility personnel properly trained in the use, and handling of the materials and aware of possible associated hazards?

S

U

NA

B. Labeling Chemicals

The following minimum essentials information is included on chemical labels:

1. Chemical name and/or trade name of the product (same as MSDS when applicable)

S U NA

2. Date received or date placed in the container.

S U NA

3. Precautions to be observed in handling or mixing the chemicals

S U NA

4. The appropriate hazard symbol National Fire Protection Association (NFPA) rating

S U NA

C. Chemical Storage and Disposal

Chemicals are stored according to the following minimum storage requirements:

1. Separate storage area from the classroom area. Appropriate warning symbols mark storage areas.

S U NA

2. Storage area is properly ventilated.

S U NA

3. Appropriate fire extinguisher(s) or extinguishing system is provided.

S U NA

4. Fire door or adequate exits are provided.

S U NA

C. Chemical Storage and Disposal *(continued)*

5. Storage shelves are securely attached to wall (each shelf with a front one-inch or 2.5 centimeter lip to prevent bottles from slipping off shelves.

S U NA

6. Chemicals are not stored past the manufacturer's suggested shelf life.

S U NA

7. Flammables, oxidizers, and corrosives are stored separately in appropriate cabinets.

S U NA

8. A Material Data Sheet (MSDS) is kept on file and be easily accessible for ALL chemicals. MSDS sheets should be referred for proper storage and for appropriate personal protection equipment (PPE). A copy of the MSDS is kept by the principal and the school nurse

S U NA

9. Materials are disposed of following appropriate MSDS sheet instruction or local, state or federal regulations.

S U NA

Comments: Please refer to specific item numbers. Use the back of this page if necessary.

ANIMAL AND PLANT CHECKLIST

School _____

Date _____

Room Number(s) _____

Teacher _____

Evaluator _____

Directions: *Circle the appropriate choice for each of the items on the checklist:*

S = Satisfactory (item meets guidelines, no action needed)

U = Unsatisfactory (item does not meet guidelines, corrective action required)

NA = Not applicable (item does not apply for this room activity)

The following precautions are taken when using animals for plants in the laboratory:

A. Animals

1. Teachers inquire about student allergies associated with animals.
S **U** **NA**

2. Teachers allow students to handle/touch animals only after proper directions and demonstrations have been given.
S **U** **NA**

3. Students wash hands after handling vertebrates and appropriate invertebrates.
S **U** **NA**

4. Teachers report any animal bites or scratches to the principal and school nurse immediately
S **U** **NA**

5. Fecal matter is never disposed of in sinks or with commonly used equipment.
S **U** **NA**

6. Wild animals are never used. Classroom animals are from reputable suppliers. Animal carcasses are never examined. Dissections are only performed on preserved animals in an approved preservative.
S **U** **NA**

A. Animals *(continued)*

- | | |
|----------|--|
| 7. | Poisonous animals are never in the classroom. |
| S | U NA |
| 8. | Students are never allowed to tease animals or touch animals to their mouths. Animals are treated humanely at all times. |
| S | U NA |
| 9. | All aspects of animal well-being are met. This includes during periods when school is not in session. |
| S | U NA |
| 10. | Euthanasia, when necessary, is performed humanely and out of sight of the students. |
| S | U NA |

B. Plants

- | | |
|----------|---|
| 1. | Teachers inquire beforehand about student allergies associated with plants. |
| S | U NA |
| 2. | Poisonous or allergy-causing plants are never used in the classroom. |
| S | U NA |
| 3. | A clear distinction is made between edible and non-edible plants. |
| S | U NA |
| 4. | Plants are never tasted without clear direction from the teacher. |
| S | U NA |

Comments: Please refer to specific item numbers.

SCIENCE LABORATORY PROTECTIVE EQUIPMENT CHECKLIST

School _____

Date _____

Room Number(s) _____

Teacher _____

Evaluator _____

Directions: Circle the appropriate choice for each of the items on the checklist:

S = Satisfactory (item meets guidelines, no action needed)

U = Unsatisfactory (item does not meet guidelines, corrective action required)

NA = Not applicable (item does not apply for this room activity)

The following protective equipment is kept/provided in a laboratory for teachers and students to use:

1. Master shut off valves/switches is located within each laboratory, preferably in one secure location accessible only to the instructor. Water, gas, and electricity are turned off when not in use.

S **U** **NA**

2. Adequate numbers of tri-class ABC fire extinguishers are strategically placed within 30 steps or 15 seconds of any location in the room. These are checked and certified as fully charged and in working order at least every year.

S **U** **NA**

3. Eye wash stations are forearm operated or foot-operated for hand-free operation. Eye wash station is unobstructed.

S **U** **NA**

4. Forearm or foot-operated face/body sprayers, with adequate flexible hoses and water pressure, are strategically placed within 30 steps or 15 seconds from any location in the room. If a standard plumbed safety shower unit is used, it should provide potable water at a flow rate of 30-60 gallons/minute at a pressure of 20-50 p.s.i.

S **U** **NA**

SCIENCE LABORATORY PROTECTIVE EQUIPMENT CHECKLIST *(continued)*

5. An appropriate fume hood, vented through the roof to at least 8 feet above the roof line, has a face velocity of 60-100 feet/minute of air through the hood. The hood is not within 10 feet of an exit or on a main aisle. The fume hood is never used for storage.

S U NA

6. Retardant-treated wool fire blankets, free of friable asbestos, are prominently labeled and strategically placed within 30 steps or 15 seconds of any location in the room.

S U NA

7. American National Standards Institute (ANSI) coded Z87 or Z87.1 approved safety goggles are provided for each student when there is a danger of chemical projectile hazard.

S U NA

8. Non-absorbent, chemical-resistant aprons are provided for each student during laboratory activities where there is danger of spilling or splattering of chemicals.

S U NA

9. A container is provided and clearly marked for the disposal of broken glass only.

S U NA

10. Vinegar and sodium bicarbonate (baking soda) are available for neutralization of bases and acids respectively. Disinfectants such as 10% Clorox bleach solution are used to sanitize equipment and to wash down counter tops after working with biological materials.

S U NA

11. Emergency procedures and telephone numbers are prominently posted in the room.

S U NA

Comments: Please refer to specific item numbers

APPENDIX A—LIST OF CHEMICALS THAT ARE NOT TO BE USED FOR SCIENCE INSTRUCTION IN RED CLAY

(NOTE: These chemicals listed are in addition to those chemicals stipulated by Administrative Memorandum “Reporting and Storage of Hazardous Chemicals in Schools”

Alkali metals (elemental)
Any radioisotopes
Benzene
Carbon disulfide
Chlorine gas
Chloroform
Chromic acid
Controlled substances (by the Drug Enforcement Agency)
Diethyl ether
Formaldehyde
Gasoline
Hydrofluoric acid
Kerosene
Mercury (includes any mercury containing compounds)
Methylene chloride
Nicotine
Picric acid
Sodium peroxide

Chemicals to be used only by advanced science classes in small amounts:

Glacial acetic acid
Nitric acid
Sulfuric acid

APPENDIX B—APPEARANCE OF POISONOUS PLANTS THAT POSE A HAZARD

1. Poison Ivy:



Poison Ivy, shown here with box elder.

Identifying characteristics of Poison Ivy:

- Grows among other plants.
- Three leaflets per branch
- Leaves have a shiny covering. Leaves are green, darkening over the summer
- Leaflet have a jagged “mitten-shape” (“looks like mittens, itches like the dickens”)
- Forms small white berries
- All parts cause painful itching within two days of contact.

2. Jimsonweed:



Jimsonweed, showing leaves, flowers, and seed pod.

Identifying characteristics of jimsonweed:

- Grows into a large bush up to 7 feet high
- Serrated “elm-like” leaves
- Long white flowers that usually don’t open
- Walnut sized seed capsule, sometimes covered in spines
- Ingestion causes poisoning, characterized by extreme dehydration, hallucinations, seizures, and death
- All parts of the plant are extremely poisonous

APPENDIX C: RED CLAY ADMINISTRATIVE MEMORANDA RELEVANT TO SCIENCE SAFETY

<https://rcweb.redclay.k12.de.us/Intranet/AM/AMindex.htm>

To: Administrators

From: Mervin B. Daugherty, Ed.D. Superintendent

Subject: Student Data Required for Field Trips

It is imperative that schools consistently maintain student data in case parent contact is necessary due to a bus emergency or accident. The following information must be kept up-to-date:

1. Parent/guardian name, address, emergency contact, and telephone number
2. Complete bus information including bus number, trip, and stop

It is the responsibility of the principal to instruct all personnel completing such forms to make periodic checks to ensure that the information is updated as necessary.

Principals shall inform appropriate personnel that student lists with complete information must be given to the bus driver prior to leaving the school for all field trips or sporting events. Bus drivers leaving the school without the appropriate list shall be subject to discipline. If the list is not available prior to the departure of the field trip, the bus driver is to wait until such list is submitted. If the list is not submitted within a reasonable time, the bus driver is to call the Transportation Office for instructions. The school administrator should also receive a copy of the field trip list prior to the departure of the field trip.

Questions about the information contained in this administrative memorandum should be directed to the appropriate Director of Schools.

Authorizing Code(s):
Office(s) Responsible:
Last Issued:
Last Revised:
Attachment(s):

Red Clay Consolidated School District Board of Education Policy 7004
Deputy Superintendent for Student Support Services
11/01/2011
11/01/2011
Not applicable

To: Administrators
From: Mervin B. Daugherty, Ed.D. Superintendent
Subject: Field Trips

In accordance with Red Clay Consolidated School District Board Policy 7004 Field Trips, school and District personnel are permitted and encouraged to undertake planned field trips that have educational merit and that complement approved curriculum goals.

This administrative memorandum establishes the District's administrative procedures governing field trips. These procedures apply to any field trip sponsored by a District school.

Field Trip Application Process

A teacher who wishes to sponsor a field trip ("sponsor") must obtain prior approval of the trip through the following application process:

1. At least 20 days prior to the date of the trip, the online Field Trip Request Form must be approved by the principal. An uploaded copy of the District's parent/guardian permission slip that will be used for the trip must be attached to the form.
 - a. If the trip involves overnight, out-of-state, or out-of-country travel, the sponsor must complete the section for overnight or out-of-country travel.
 - b. If the duration of the trip is greater than three days, the sponsor must attach an itinerary with the details for the additional days.
2. Upon submission of the required form, the request is routed to the sponsor's principal for building-level approval.
3. Upon building-level approval, the request is routed to the Transportation Department for verification of bus availability and a rate quote.
4. Within 48 hours of receiving the request, notification is sent by the Transportation Department to the sponsor to provide confirmation of bus availability and a rate quote.
 - a. If the Transportation Department does not have buses available, they will recommend other carriers that may be used to provide transportation for the trip.
 - b. The sponsor has the right to get a quote from another carrier once the trip has been quoted by the Transportation Department. If the carrier provides a lower quote, the sponsor must advise the contractor and must forward the quote to the Transportation Department.
 - c. A rate schedule and bus rules for field trip transportation may be determined by the Transportation Department.

5. Upon confirmation of bus availability, the request is routed to the appropriate Director of Schools for final, District-level approval.
6. Upon District-level approval, notification is sent to the sponsor and to the Nutrition Department to inform them that the trip is approved.

Field Trip Sponsor Responsibilities

Once the sponsor has obtained approval of the trip, and *prior to the date of the trip*, the sponsor must do the following:

1. Complete a professional absence request.
2. Obtain Red Clay parent/guardian permission slips from all students going on the trip.
3. Provide the principal or the principal's designee with an alphabetized list of the names of all students going on the trip.

The sponsor is responsible for ensuring that all applicable Board, District, and school guidelines are followed during the course of the trip. Specifically:

1. An alphabetized list of the names of students on the trip must be in the sponsor's possession at all times.
2. At least one professional staff member must be assigned to each bus.
3. Additional guidelines governing field trips are established in state laws and regulations, Board policies, administrative memoranda (see "Meeting the Medical Needs of Students on Field Trips" and "Student Data Required for Field Trips"), and the Student Code of Conduct.

Questions about the information contained in this administrative memorandum should be directed to the appropriate Director of Schools.

Authorizing Code(s):	Red Clay Consolidated School District Board of Education Policy 7004
Office(s) Responsible:	Deputy Superintendent for Student Support Services
Last Issued:	11/01/2011
Last Revised:	11/01/2011
Attachment(s):	Field Trip Request Form (available at https://rcweb.redclay.k12.de.us/Intranet/FRM/FRMindex.htm) Permission Slip (available at https://rcweb.redclay.k12.de.us/Intranet/FRM/FRMindex.htm)

To: Principals Nurses
From: Mervin B. Daugherty, Ed.D. Superintendent
Subject: Assistance with Medications on Field Trips

Nursing care required by a student cannot be delegated to non-nursing personnel. The school is required to meet the medical needs of students on field trips, as well as in the school building.

Subject to the provisions of 14 DE Admin Code 817, teachers, paraprofessionals, and administrators employed by the District may assist a student with medications during a field trip, provided that the respective staff member has successfully completed a Board of Nursing approved training course developed by the Delaware Department of Education. The school nurse shall determine which staff members who have completed the course are qualified to safely assist a student with medication. The school nurse will submit names of those employees who are eligible to assist students with medications to the Health Specialist at DOE.

Per 14 DE Admin Code 817, except for a school nurse, no District employee shall be compelled to assist a student with medication. Lay assistants shall not assist with injections; the one exception is with emergency medications where standard emergency procedures prevail in lifesaving circumstances.

Assistance with medication will not be provided without the prior written request or consent of a parent. Said written request or consent must contain clear instructions including the student's name, the name of the medication, the dose, the time of administration, and the method of administration.

The medication to be administered on the field trip shall be properly labeled with the student's name; the licensed health care provider's name; the name of the medication; the dosage; how and when it is to be administered; the name and phone number of the pharmacy and the current date of the prescription.

Parent/guardians of students with chronic health needs or fragile medical conditions should be encouraged to accompany their children on field trips. If they are unable to attend the trip and the student requires nursing assessment or treatment for a medical condition, a nurse must go on the field trip to provide these services.

Parents/guardians or other family members who participate in the field trip may administer medications to their respective child. They are not permitted to assist other students with their medications.

School staff may assist with oral, topical, or inhaled medication administration under the provisions of state regulations and related administrative memoranda.

Students in middle school or high school might be capable of self care. Considerations should include whether the student is physically and developmentally able to assume this responsibility and whether they possess appropriate knowledge and experience. The student's competence must be documented by the school nurse. Written parental permission and physician directions are needed for the student to self care. The student must have an emergency healthcare plan covering self care.

A copy of the Field Trip Application Form must be submitted to the school nurse when the trip is planned. Arrangements for a substitute nurse to accommodate student needs on a field trip will be made by the school nurse in collaboration with the building administrator.

Note: Overnight trips may require additional medical supervision.

Additional guidance can be found in the Delaware Department of Education School Nursing: Technical Assistance Manual (Section A, pp. 57-58; Section B, pp. 76-77, 83-87, 89), Delaware Nurse Practice Act, and National Association of School Nurses Position Statement on Field Trips and Extended School Trips (available at www.nasn.org under “Position Statements”).

Questions about the information contained in this administrative memorandum should be directed to the Manager of RTTT and Compliance.

Authorizing Code(s):	14 DE Admin Code 817 Red Clay Consolidated School District Board of Education Policy 7004
Office(s) Responsible:	Superintendent
Last Issued:	10/31/2011
Last Revised:	10/31/2011
Attachment(s):	14 DE Admin Code 817 (available at http://regulations.delaware.gov/AdminCode/title14/800/817.pdf)

To: Principals

From: Mervin B. Daugherty, Ed.D. Superintendent

Subject: Reporting and Storage of Hazardous Chemicals and Waste in Schools

Attached please find the following documents which concern the reporting and storage of hazardous chemicals and waste:

1. Storage Limits of Chemicals in Secondary Schools
2. 14 DE Admin Code 885 Safe Management and Disposal of Chemicals in the Delaware Public School System

Particular attention should be given to the various Department of Education report dates and the specific responsibilities of District secondary schools that use these materials in their science programs.

Questions about the information contained in this administrative memorandum should be directed to the Assistant Superintendent for District Operations.

Authorizing Code(s):

Office(s) Responsible:

Last Issued:

Last Revised:

Attachment(s):

14 DE Admin Code 885

Assistant Superintendent for District Operations

09/01/2010

01/20/2009

Storage Limits of Chemicals in Secondary Schools

*14 DE Admin Code 885 Safe Management and Disposal of Chemicals
in the Delaware Public School System*

STORAGE LIMITS OF CHEMICALS IN SECONDARY SCHOOLS

EXPLOSIVE CONTAINER AND MAXIMUM ITEM RESTRICTIONS QUANTITY

Chemical	container	Maximum quantity
Ammonium nitrate	Glass	1 lb.
Hydrogen peroxide,	30% Original vented container	2 qts.
Perchloric acid	Glass	1 lb.
*Picric acid		None
Compressed Gases		
Ammonia (anhydrous)	Steel cylinder	Lecture bottle
Carbon dioxide	Steel cylinder	Lecture bottle
Chlorine	Steel cylinder	Lecture bottle
*Fluorine		None
Helium	Steel cylinder	Lecture bottle
Hydrogen	Steel cylinder	Lecture bottle
*Hydrogen sulfide		None
Nitrogen	Steel cylinder	Lecture bottle
*Sulfur dioxide		None
Other compressed gases	Steel cylinder	Lecture bottle
Flammable Liquids		
Acetaldehyde	Glass	2 lbs.
Acetone	Metal can, glass, polypropylene bottle	5 lbs.
Amyl acetate	Glass	2 lbs.
Aniline	Glass	1 lb.
*Benzene or naphtha		None
*Carbon disulfide		None.
*Coal tar		None
Crude petroleum	Metal can	2 pts.
Essential oils	Glass	2 lbs.
Ethanol	Metal can or glass	2 gals.
*Ether		None
Magnesium (powder)	Glass or metal can	1 lb.
Magnesium (ribbon)	Glass, paper envelope, or metal can	1 lb.
Naphthalene	Glass	5 lbs.
*Phosphorus (white)		None
*Phosphorus (red)		None
Powdered charcoal	Glass	5 lbs.
Resins, Balsams, or other gums	Glass	1 lb.
Sulfur Metal	glass	5 lbs.
Tar, refined (wood)	Glass	1 lb.
Zinc dust	Glass or metal can	2 lbs.

ARCHIVE

Dangerously Corrosive or Caustic Chemicals acids are “concentrated” unless otherwise noted.
Store acids in “Acids” cabinet.

Acetic acid (glacial)	Glass (5 pt. cap.)	2-1/2 gals.
Bromine	Glass	100 ml.
*Chromic acid		None
Hydrochloric acid	Glass (5 pt. cap.)	5 gals.
*Hydrofluoric acid		None
Hydrogen peroxide, 30%	Original vented container	2 qts.
Nitric acid	Glass (5 pt. cap.)	2-1/2 gals.
(note: store nitric acid separately from other acids)		
Perchloric acid	Glass	1 pt.
Phenol	Glass	1 lb.
Potassium hydroxide	Glass (HDPE preferred)	10 lbs.
Sodium hydroxide	Glass (HDPE preferred)	10 lbs.
Sulfuric acid	Glass (5 pt. cap.)	5 gals.

Oxidizing Agents Store in “oxidizer” cabinet.

Ammonium nitrate	Glass	1 lb.
Barium nitrate	Glass	1 lb.
*Barium peroxide		None
Bismuth subnitrates	Glass	1 lb.
Cobalt nitrate	Glass	1 lb.
Ferric nitrate	Glass	2 lbs.
Hydrogen peroxide, 3%	Glass	1 gal.
Metallic chlorates	Glass	1 lb.
Metallic nitrates (other)	Glass	1 lb.
Metallic permanganates	Glass	1 lb.
Potassium chlorate	Glass	1 lb.
Potassium nitrate	Glass	5 lbs.
Potassium permanganate	Glass	2 lbs.
Silver nitrate	Glass	2 lbs.
Sodium nitrate	Glass	1 lb.
*Sodium peroxide		None
Strontium nitrate	Glass	1 lb.

Substances Dangerous in Contact with Water

Calcium	Glass	1 lb.
Calcium hydride	Metal can (sealed)	2 lbs.
Calcium oxide	Glass or metal can	2 lbs.
*Lithium		None
*Sodium		None
*Potassium		None

Carcinogens:

Carcinogens are compounds or substances that may produce malignant tumors or other forms of cancer upon exposure. They are insidious poisons since their harmful effects are not immediately apparent. Cancers usually do not develop until many months, or even many years after exposure to carcinogenic materials. For this reason, great care should be taken to avoid exposure to any substance expected of being a carcinogen.

In 1974 the Occupational Safety and Health Administration (OSHA) classified 14 chemicals as dangerous carcinogens and issued standards which include specific procedures for working with these chemicals. Later, 6 additional chemicals were added to the list. Subsequently, a number of other compounds were identified by the ACGIH and industrial companies such as Du Pont as being strong carcinogens that pose a very significant health risk.

THESE POTENT CARCINOGENS ARE LISTED IN TABLES I AND II. SINCE THE RISK OF USING THESE COMPOUNDS GREATLY OUTWEIGHS THE POSSIBLE BENEFITS, THE COMPOUNDS IN THESE TABLES SHOULD NOT BE STORED OR USED IN THE SCHOOL LABORATORIES, AND IF PRESENT, THEY SHOULD BE REMOVED.

OSHA CARCINOGENS (THESE SUBSTANCES ARE NOT TO BE USED)

2-Acetylaminofluorine Ethyl Carbamate (Urethane)
1,2-Dibromo-3-chloropropane (DBCP) Aniline (and salts)
Acrylonitrile Ethylene Oxide
4-Aminodiphenyl Benzene
3,3'-Dichlorobenzidine (and salts) Formaldehyde (including preserved animals)
Arsenic, inorganic Chloroform
4-Dimethylaminoazobenzene o-Toluidine
Arsenic pentoxide 2,4-Dinitrotoluene
Ethyleneimine 1,3-Propane Sulfone
Arsenic trioxide Hexamethylphosphoramide
Methyl Chloromethyl Ether Propyleneimine
Asbestos Hydrazine (and salts)
alpha-Naphthylene (Naphthylamine) Hydrazine (and salts)
Benzidine 2,3,4-Trichloro-1-butene
beta-Naphthylene (Naphthylamine) 4,4'-Methylene Bis (2-chloroaniline)
Bis(chloromethyl) Ether Acetamide
4-Nitrodiphenyl (aminodiphenyl) (and salts) p-Dioxane
N-Nitrosodimethylamine Anthracene
Coal Tar Pitch Volatiles
beta-Propiolactone
Coke Oven Emissions
Sodium Arsenite
Vinyl Chloride
Benz(a)pyrene
4,4'-Methylene Dianiline (and salts)
2,4-Diaminotoluene
Monomethylhydrazine (and salts)
1,4-Dichloro-2-buten N-(2-Hydroxyethyl)ethyleneimine
Dimethylcarbamoyl Chloride
Nitrosamines
1,1-Dimethylhydrazine
2-Nitronaphthalene
Dimethyl Sulfate

Reproductive Toxins: Reproductive Toxins are compounds or substances which produce harmful effects on the female and/or male reproductive system and include:

- *Embryotoxins affecting the fertilized egg or embryo during its development
- *Teratogens producing malformation of the fetus.
- *Reproductive toxins affecting the male reproductive system.

Like carcinogens, reproductive toxins are insidious poisons, since their harmful effects are not immediately apparent. Several common solvents and lead and its salts have been classified by OSHA, ACGIH and/or duPont's Haskel Laboratory as reproductive toxins that pose a significant health risk, and are listed in Table IV. These compounds should not be stocked or used in the school laboratories.

IT IS PARTICULARLY IMPORTANT THAT FEMALES OF CHILD BEARING AGE ARE NOT EXPOSED TO TERATOGENS OR EMBRYOTOXINS.

REPRODUCTIVE TOXINS

Compound

Dimethylacetamide (DMAC)
Dimethylformamide (DMF)
2-Ethoxyethanol#
(Cellosolve®)
Ethylenethiourea
Formamide Teratogen,
Hexafluoroacetone (HFA)
and its Hydrates
Lead, Acetate,
Nitrate, Oxide

Classification

Embryotoxin
Embryotoxin
Teratogen
Embryotoxin and Teratogen
Embryotoxin
Embryotoxin, Male Reproductive Toxin

Teratogen (mental retardation)
Teratogen
Embryotoxin and Teratogen

OTHER:

Mercury and mercury containing compounds:

All mercury and mercury containing compounds (symbol for mercury: Hg) must be removed from all schools by a licensed hazardous waste disposal company. This includes any instrumentation (e.g. thermometers) containing mercury.

Latex gloves and balloons:

Because of the hazard posed by latex allergy, latex balloons and latex gloves should not be used in any science classrooms.

REFERENCES

Printed

Code of Federal Regulations (CFR) Title 29, Chapter 5, Section XVII, Occupational Safety and Health Administration (OSHA) Standards, 2005.

Delaware Code, Title 14: Education (pertinent chapters), Title 16: Health and Safety (pertinent chapters)

Flinn Chemical & Biological Catalog/Reference Manual, 2005

Furr, A.K. *CRC Handbook of Laboratory Safety*, 5th Edition. Boca Raton, FL, CRC Press, 2000.

Safety First, Delaware Department of Education, August 2011

Websites

American Academy of Allergy, Asthma, & Immunology. "Tips to Remember: What is Anaphylaxis?"

<http://www.aaaai.org/patients/publicedmat/tips/whatisanaphylaxis.stm>

Council of State Science Supervisors. Science Safety Information to Download

<http://www.csss-science.org/safety.shtml>

Chemical Sampling Information, Occupational Safety & Health Administration:

http://www.osha.gov/dts/chemicalsampling/toc/toc_chemsamp.html

Position statement on science safety from the National Science Teachers Association

<http://www.nsta.org/about/positions/safety.aspx>

Red Clay Consolidated School District Student Code of Conduct:

<http://www.redclay.k12.de.us/psformsandpub/pdfs/09-10StudentCodeBoardOfEducation.pdf>

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